Clean Water Act Section 319(h) Nonpoint Source Pollution Control Program Project

Surface Water Quality Monitoring for the Copano Bay Total Maximum Daily Load

TSSWCB Project # 06-15

Quality Assurance Project Plan

Texas State Soil and Water Conservation Board

Prepared by:

Nueces River Authority

Effective Period: January 1, 2007 to November 30, 2010

Questions concerning this quality assurance project plan should be directed to:

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A1 Approval Page

Quality Assurance Project Plan for TSSWCB project # 06-15, *Surface Water Quality Monitoring for the Copano Bay Total Maximum Daily Load*.

United States Environmental Protection Agency (USEPA), Region VI

Name: Donna Miller
Title: State/Tribal Programs Section Chief

Signature:_____Date:_____

Name: Henry Brewer
Title: Texas NPS Project Officer

Signature:_____Date:_____

Texas State Soil and Water Conservation Board (TSSWCB)

Name: Mitch Conine
Title: TSSWCB Project Manager

Signature:_____Date:_____

Name: Donna Long
Title: TSSWCB Quality Assurance Officer (QAO)

Signature:_____Date:_____

Nueces River Authority (NRA)

Name: Rocky Freund
Title: NRA Project Manager / Quality Assurance Officer

Signature:_____Date:_____

Texas A&M University – Corpus Christi Environmental Microbiology Laboratory (TAMU-CC/EML)

Name: Joanna Mott, Ph.D.
Title: TAMU-CC/EML Quality Assurance Officer

Signature:_____Date:_____

Lower Colorado River Authority—Environmental Laboratory Services (LCRA-ELS)

Name: Hollis Pantalion
Title: LCRA-ELS Quality Assurance Officer

Signature:_____Date:_____

The Nueces River Authority (NRA) will secure written documentation from each sub-tier project participant (e.g., subcontractors, other units of government, laboratories) stating the organization's awareness of and commitment to requirements contained in this QAPP and any amendments or added appendices of this plan. NRA will maintain this documentation as part of the project's quality assurance records, and will ensure that documentation will be available for review. (An example of the letter is in Attachment 1 of this document.)

A2: Table of Contents

Tables:

Figures:

LIST OF ACRONYMS

AWRL	**Ambient Water Reporting Limit**
CAR	**Corrective Action Report**
COC	**Chain-of Custody**
CRP	**Clean Rivers Program**
CRWR	**Center for Research in Water Resources**
DO	**Dissolved Oxygen**
ELS	**Environmental Laboratory Services**
EPA	**US Environmental Protection Agency**
FY	**Fiscal Year**
LCRA	**Lower Colorado River Authority**
LCS	**Laboratory Control Sample**
LCSD	**Laboratory Control Sample Duplicate**
LOQ	**Limit of Quantitation**
ML	**Microbiology Laboratory**
NCR	**Nonconformance Report**
NELAC	**National Environmental Laboratory Accreditation Conference**
NRA	**Nueces River Authority**
QA	**Quality Assurance**
QA/QC	**Quality Assurance/Quality Control**
QAO	**Quality Assurance Officer**
QAP	**Quality Assurance Plan**
QAPP	**Quality Assurance Project Plan**
QAS	**Quality Assurance Specialist**
QC	**Quality Control**
QM	**Quality Manual**
QMP	**Quality Management Plan**
RPD	**Relative Percent Difference**
SOP	**Standard Operating Procedure**
SWQM	**Surface Water Quality Monitoring**
SWQMIS	**Surface Water Quality Monitoring Information System**
TAMU-CC	**Texas A&M University – Corpus Christi**
TMDL	**Total Maximum Daily Load**
TCEQ	**Texas Commission on Environmental Quality**
TSSWCB	**Texas State Soil and Water Conservation Board**
TSWQS	**Texas Surface Water Quality Standards**

A3 Distribution List

Nueces River Authority (NRA) will provide copies of this project plan and any amendments or appendices of this plan to each person on this list. Organizations, and individuals within, which will receive copies of the approved QAPP and any subsequent revisions include:

US Environmental Protection Agency Region 6
1445 Ross Avenue, Suite 1200; Dallas, TX 75202

Name: Henry Brewer
Title: Texas NPS Project Officer

Texas State Soil and Water Conservation Board
P.O. Box 658; Temple, TX 76503

Name: Mitch Conine
Title: TSSWCB Project Manager

Name: Donna Long
Title: TSSWCB Quality Assurance Officer (QAO)

Nueces River Authority
1201 N. Shoreline Blvd.; Corpus Christi, TX 78401

Name: Rocky Freund
Title: NRA Project Manager / Quality Assurance Officer

Name: Sam Sugarek
Title: NRA Field Supervisor

Name: Beth Almaraz
Title: NRA Field Staff

Lower Colorado River Authority— Environmental Laboratory Services
P.O. Box 220; Austin, TX 78744

Name: Hollis Pantalion
Title: LCRA-ELS Quality Assurance Officer

Name: Alicia Gill
Title: LCRA-ELS Laboratory Manager

Texas A&M University – Corpus Christi; Environmental Microbiology Laboratory
6300 Ocean Drive—Unit 5800; Corpus Christi, TX 78412-5800

Name: Joanna Mott, Ph.D.
Title: TAMU-CC/EML Quality Assurance Officer

Name: La Donna Henson
Title: TAMU-CC/EML Laboratory Manager

Texas Commission on Environmental Quality; Total Maximum Daily Load (TMDL) Team
P.O. Box 13087, MC 203; Austin, TX 78711-3087

Name: Eric Reese
Title: TCEQ-TMDL Team Project Manager

Name: TCEQ Region 14 Field Staff
Title: Quality Assurance Officer

The University of Texas at Austin; Center for Research in Water Resources (CRWR)
Pickle Research Campus; Bldg. 119, MC R8000; University of Texas; Austin, TX 78712

Name: David Maidment, Ph.D.
Title: Associate Professor

A4 Project/Task Organization

The following is a list of individuals and organizations participating in the project with their specific roles and responsibilities:

USEPA – Provides project overview and funding at the Federal level.

Henry Brewer, Texas Nonpoint Source Project Officer

Responsible for overall performance and direction of the project at the Federal level. Ensures that the project assists in achieving the goals of the federal Clean Water Act (CWA). Reviews and approves the quality assurance project plan (QAPP), project progress, and deliverables.

TSSWCB - Provides project overview and funding at the state level.

Mitch Conine, Project Lead

Responsible for ensuring that the project delivers data of known quality, quantity, and type on schedule to achieve project objectives. Tracks and reviews deliverables to ensure that tasks in the work plan are completed as specified. Responsible for reporting data to the Texas Commission on Environmental Quality (TCEQ) Surface Water Quality Monitoring Information System (SWQMIS) database.

Donna Long, Quality Assurance Officer

Reviews and approves the QAPP, amendments, and/or revisions and ensures distribution of approved or revised QAPPs to TSSWCB and USEPA participants. Responsible for verifying that the QAPP is followed by all project participants. Determines that the project meets all requirements for planning, quality assessment (QA), quality control (QC), and reporting under the CWA. Monitors implementation of corrective actions. Coordinates and/or conducts audits of field and laboratory systems and procedures.

NRA - Provides the primary point of contact between TSSWCB and the project contractors. Tracks and reviews deliverables to ensure that tasks in the work plan are completed as specified. Responsible for coordination, review, and delivery of quarterly reports.

Rocky Freund, Project Manager / Quality Assurance Officer

Coordinates project planning activities. Ensures monitoring systems audits are conducted to ensure the QAPP is followed by project participants and that the project is producing data of known quality. Ensures that subcontractors are qualified to perform contracted work and that field staff training records are maintained. Responsible for writing, and maintaining, the QAPP, its implementation, and records of QAPP distribution (including amendments and revisions). Maintains written records of sub-tier commitment to requirements specified in this QAPP. Coordinates with the TSSWCB Project Lead and QAO to resolve QA-related issues, including any project deficiencies, nonconformance and corrective actions. Responsible for validating that data collected are acceptable for reporting to TSSWCB.

Sam Sugarek, Field Supervisor

Coordinates field sampling and data collection activities and supervises the field personnel in conducting sampling events. Ensures that all field personnel are properly trained and equipped to conduct the necessary monitoring and that all sampling procedures are followed according to the QAPP. Ensures that personnel, supplies, and equipment are available at all appropriate times.

Beth Almaraz, Field Staff

Conducts field sampling and data collection activities. Supports the NRA Field Supervisor to ensure that all field personnel are properly trained and equipped to conduct the necessary monitoring and that all sampling procedures are followed according to the QAPP. Supports the NRA Field Supervisor to ensure that personnel, supplies, and equipment are available at all appropriate times.

TAMU-CC/EML - Performs *E. coli*, Enterococcus and Fecal Coliform analysis on project water samples.

Amanda Smith, Laboratory Manager

Responsible for oversight of all microbiology laboratory operations, ensuring adequate training and supervision of all activities involved in generating analytical data. Ensures that analytical tests are performed in accordance with approved methods and that laboratory personnel maintain adequate (QA/QC) procedures during the time samples are being analyzed, with all results presented in an organized manner. Enforces corrective action, as required

Joanna Mott, Ph.D., Quality Assurance Officer

Oversees bacteriological analyses on water samples*: E. coli*, Enterococcus, and Fecal Coliform. Responsible for ensuring all laboratory personnel have a thorough knowledge of the laboratory QM/QAPP and all SOPs specific to the analyses or task performed and/or supervised. Ensures that analytical tests are performed in accordance with approved methods. Serves as QAO and performs significant data review, verification, and validation roles. Ensures that the laboratory maintains adequate QA/QC procedures during the time samples are being analyzed and that all results are presented in an organized manner. Enforces corrective action, as required.

LCRA—ELS - Performs TSS and Turbidity analyses on project water samples:.

Alicia Gill, Laboratory Manager

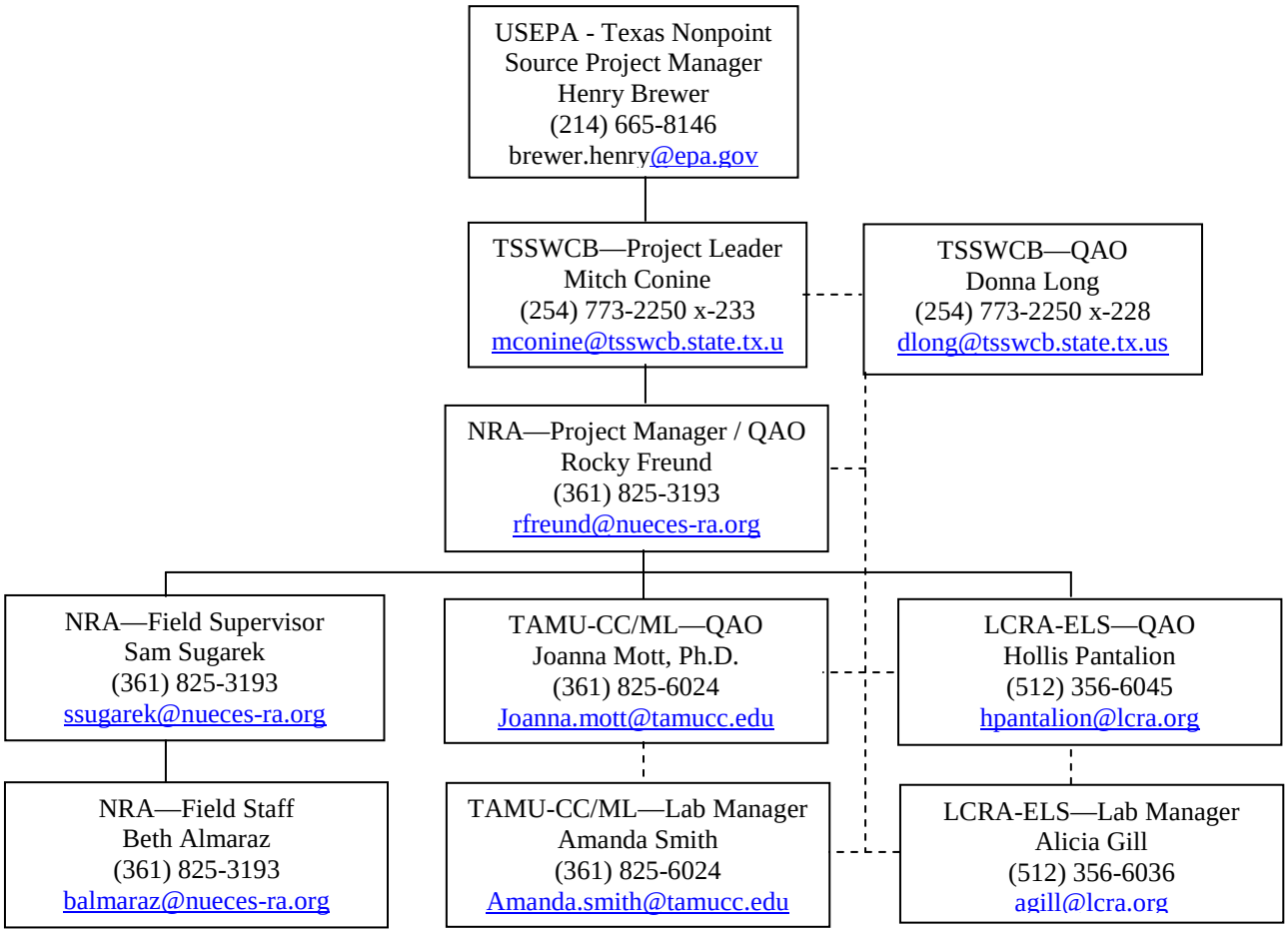
Responsible for oversight of all laboratory operations, ensuring adequate training and supervision of all activities involved in generating analytical data. Ensures that analytical tests are performed in accordance with approved methods and that the laboratory maintains adequate (QA/QC) procedures during the time samples are being analyzed, with all results presented in an organized manner. Enforces corrective action, as required

Hollis Pantalion, Quality Assurance Manager

Monitors the implementation of the QAPP within the laboratory to ensure complete compliance with QA objectives as defined by the contract and in the QAPP. Conduct in-house audits to identify potential problems and ensure compliance with written SOPs. Responsible for supervising all aspects of QA/QC in the laboratory. Perform validation and verification of data before the report is sent to the Laboratory Manager.

PROJECT ORGANIZATION CHART

Figure A4.1. Organization Chart - Lines of Communication



A5 Problem Definition/Background

Copano Bay is located in the San Antonio Nueces Coastal Basin. The bay covers parts of Aransas and Refugio Counties. Mission Bay and Port Bay are sub-bays of Copano Bay and are included in Segment 2472 (Figure A5.1). Segment 2472 is the receiving body of the Mission and Aransas Rivers. Mission River above Tidal (Segment 2002) begins at the confluence of Blanco and Medio Creeks in Refugio County and is 9 miles in length. Mission River Tidal (Segment 2001) begins at a point 4.6 miles downstream of US 77 in Refugio County, is 19 miles in length, and flows into Mission Bay. Aransas River above Tidal (Segment 2004) begins at the confluence of Poesta and Aransas Creeks in Bee County and is 35 miles in length. Aransas River Tidal (Segment 2003) begins at a point one mile upstream of US 77 in Refugio/San Patricio County, is 6 miles in length, and flows into Copano Bay. The Aransas River forms a portion of the boundary between Refugio and San Patricio Counties, from the Bee County line to the bay.

Figure A5.1

According to the *2008 Texas Water Quality Inventory and 303(d) List*, Copano Bay (Segment 2472) is impaired for bacteria in oyster waters (category 5c) in the area along the southern shore including Port Bay and the area near Bayside.

Mission River Tidal (Segment 2001), is impaired for bacteria for contact recreation. Aransas River Tidal (Segment 2003) is impaired for bacteria for contact recreation and has a concern for orthophosphorus. Aransas River Above Tidal (Segment 2004) has concerns for low dissolved oxygen, nitrate, orthophosphorus, and total phosphorus. Aransas Creek (Segment 2004A) is impaired for bacteria for contact recreation and has a concern for low dissolved oxygen.

A Total Maximum Daily Load (TMDL) study to address the bacteria in Copano Bay was initiated in 2003 by TCEQ. There are two major components to the study. The first is the development of a Bacteria Loadings Model for the entire Copano Bay watershed. Nonpoint source contributions were based primarily on land use/land cover information and estimated livestock densities of each county. Point source contributions include wastewater treatment facilities(WWTFs), septic systems, and direct deposition by water birds.

The second component of the study is Bacterial Source Tracking for the area around and in Copano Bay. This is a technique to determine animal sources of fecal contamination in a water body. TAMU-CC conducted antibiotic resistance analysis and found contributions from humans/sewage and livestock, under high river flow and rainfall, and ducks. Other wildlife and gulls contributed relatively little contamination.

The Texas Department of State Health Services (DSHS) uses fecal coliform as the indicator bacteria to access bacteria contamination in oyster waters. TCEQ uses *E. coli* and enterococcus as the indicator bacteria to access bacteria contamination in fresh and marine waters, respectively, for contact recreation use. This *SWQM for Copano Bay TMDL* project will collect fecal coliform, *E. coli*, and enterococcus samples at all locations.

TCEQ has hosted several public meetings regarding the TMDL project for Copano Bay. Stakeholders at those meetings have expressed concern regarding the limited dataset, both in number of samples used in the analysis and in the geographic extent of samples. SWQM data collected through this project may be utilized to better understand fate and transport mechanisms of bacteria in the Copano Bay watershed. SWQM data collected through this project may be utilized to enhance the TMDL model, as well as, to clarify the 5c impairments in the tidal portions of Mission and Aransas Rivers. Additionally, SWQM data collected through this project may be utilized to monitor water quality improvement and implementation progress of any TMDLs adopted for the Copano Bay watershed.

Currently, routine ambient water quality data is collected quarterly under the Clean Rivers Program (CRP) at 4 river stations and 3 bay stations by the NRA (12943, 12944, 12947, 12952, 12945, 13404, and 13405); and at two bay stations by TCEQ (14783 and 17724). This project will generate data of known and acceptable quality for surface water quality monitoring of river stations on Segments 2472 (Copano Bay), 2001/2002 (Mission River), and 2003/2004 (Aransas River), and unclassified streams in the upper portion of the watershed for field, conventional (TSS and turbidity), flow (non-tidal river segments), and bacteria parameters to support the TMDL for bacteria in oyster waters in Copano Bay

in Aransas and Refugio Counties. The project will provide for surface water quality monitoring for 39 months. Three types of surface water quality monitoring will be conducted: routine ambient, targeted bi-monthly watershed and effluent.

This *SWQM to Support Copano Bay TMDL* project will provide for up to 24 surface water quality monitoring events through November 2010 at up to 26 sites (Figure A5.2). The project, to date, has collected 6 dry weather events and 4 wet weather events. A wet event is defined as when either USGS gauge station 08189500, Mission River at Refugio, or 08189700, Aransas River near Skidmore, reaches its 70% flow; 33 cfs and 7.3 cfs respectively. Beginning November 2009, bi-monthly sampling will be conducted**.** Turbidity will not be collected in the event that the 48 hour holding time requirement cannot be met. Specific sampling sites will be re-evaluated each year.

WWTFs will be sampled during each of the sampling events if feasible. There are 16 permitted WWTFs in the Copano Bay watershed, 12 that discharge into the watershed. Coordination with TPDES permittees and TCEQ will be required. TCEQ will collect fecal coliform samples for NRA during their routine quarterly sampling, when possible, and NRA will add *E. coli*, enterococcus, and fecal coliform to its samples (when not already included) during routine quarterly sampling.

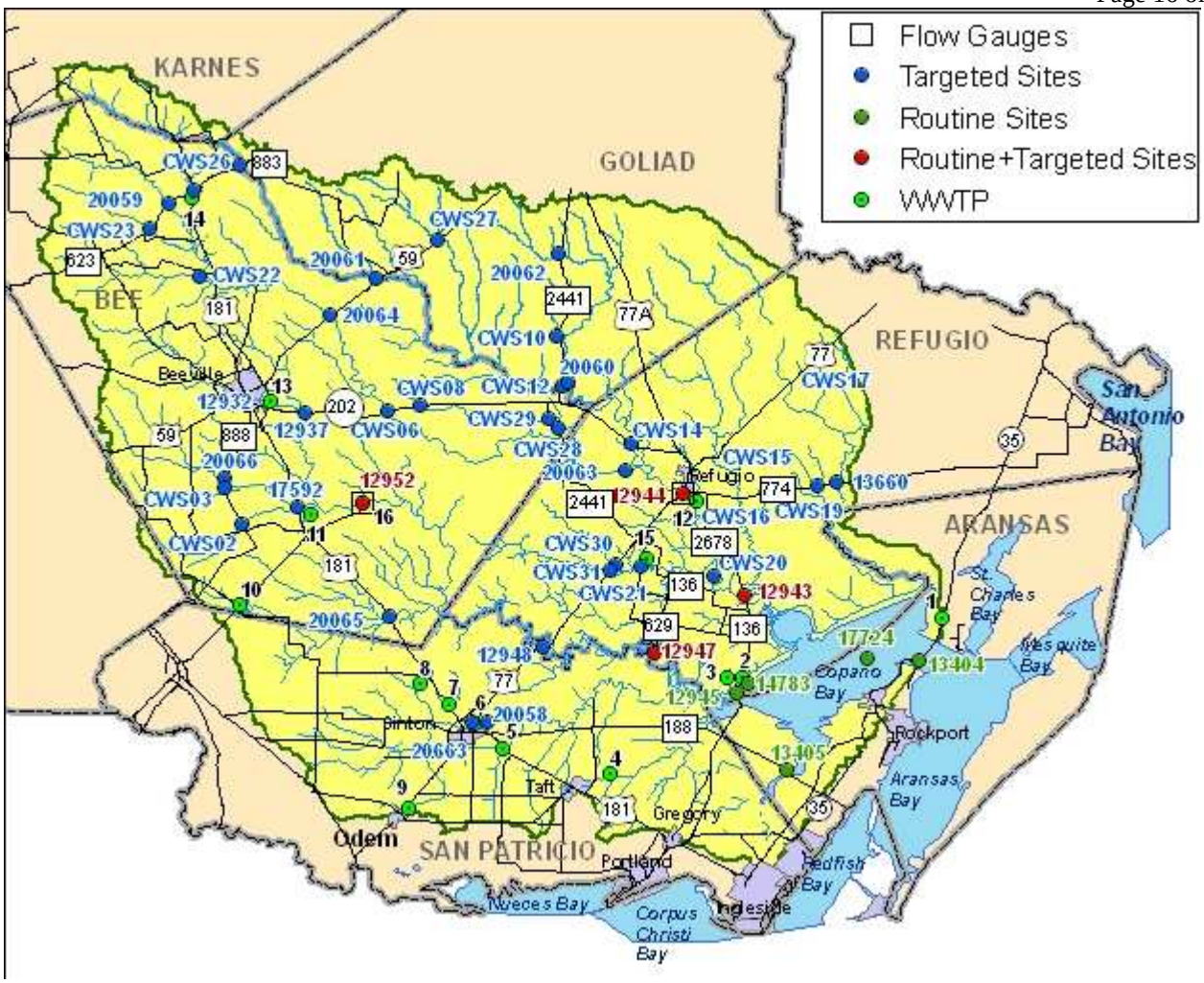


Figure A5.2

NRA will conduct most of the work performed under this project including technical and financial supervision, preparation of status reports, surface water quality monitoring sample collection, and data management. Data analysis for conventional parameters will be performed by the Lower Colorado River Authority (LCRA) Environmental Laboratory Services (ELS) under NRA's current agreement for Clean Rivers Program (CRP) data analysis. Bacteria analysis will be performed by the Environmental Microbiology Laboratory at Texas A&M University – Corpus (TAMU-CC/EML). NRA will participate in the Copano Bay TMDL stakeholder meetings in order to efficiently and effectively achieve project goals and to summarize activities and achievements made throughout the course of this project.

The sampling period extends for 39 months through November 2010. This QAPP identifies the specific sites out of 37 identified potential sites, beyond the 9 sites currently being sampled quarterly. Most of the sites are located on unclassified tributaries of the Mission and Aransas Rivers.

The purpose of this QAPP is to clearly delineate NRA QA policy, management structure, and procedures which will be used to implement the QA requirements necessary to verify and validate the surface water quality data collected. The QAPP is reviewed by TSSWCB and EPA to ensure that data

generated for the purposes described above are scientifically valid and legally defensible. This process will ensure that data collected under this QAPP have been collected and managed in a way that guarantees its reliability and therefore can be used in water quality assessments and other programs deemed appropriate by the TSSWCB. Project results will be used to support the Copano Bay TMDL for Bacteria.

NRA will post monitoring data to the NRA website in a timely manner. NRA will summarize the results and activities of this project through inclusion in NRA's CRP Basin Highlights Report and/or Basin Summary Report. Additionally, the results and activities of this project will be summarized in the Copano Bay TMDL for Bacteria.

Federal funds will provide for water quality sample collection and analysis of water quality samples. TSSWCB will provide funds sourced from general revenue to support additional analysis of samples. NRA and TCEQ CRP will each provide portions of the non-federal (cooperator) match.
(See Appendix B, Table B1.1, for station descriptions and information and Appendix B, Table B1.2 for WWTF locations.)

A6 Project/Task Description

See Appendix A for the project-related work plan tasks and schedule of deliverables for a description of work defined in this QAPP.

See Appendix B for sampling design and monitoring pertaining to this QAPP.

Amendments to the QAPP

A review and update of the QAPP will be conducted annually. Minor revisions, not critical to the sampling regime, will be submitted at that time. Critical revisions to the QAPP may be necessary prior to the annual review and update period if there is a need to address incorrectly documented sampling information or to reflect changes in project tasks, schedules, objectives, and methods. Requests for QAPP revisions will be directed from the NRA Project Manager to the TSSWCB Project Manager electronically. Revisions are effective immediately upon approval by the TSSWCB QAO, and EPA. The most recent, approved version of the QAPP will be circulated to personnel on the distribution list by the NRA Project Manager.

A7 Quality Objectives and Criteria

The monitoring planned for this project is to provide event based (dry/low flow and wet/runoff) bacteria levels to be used in the watershed model being developed for the TMDL for Bacteria in Copano Bay. The data collected for this project will help to identify the areas of the watershed that are the most likely sources of bacteria loading.

The measurement performance specifications to support the project objectives for a minimum data set are specified in Table A7.1 and in the text following.

Table A7.1 - Measurement Performance Specifications

PARAMETER	UNITS	MATRIX	METHOD	Parameter Code	AWRL	Limit of Quantitation (LOQ)	PRECISION (RPD of LCS/LCSD)	BIAS (%Rec. of LCS)	Lab
pH	pH/ units	water	EPA 150.1 and TCEQ SOP, V1	00400	NA*	NA	NA	NA	Field
DO	mg/L	water	EPA 360.1 and TCEQ SOP, V1	00300	NA*	NA	NA	NA	Field
Conductivity	uS/cm	water	EPA 120.1 and TCEQ SOP, V1	00094	NA*	NA	NA	NA	Field
Salinity	ppt, marine only	water	SM 2520 and TCEQ SOP, V1	00480	NA*	NA	NA	NA	Field
Temperature	B C	water	EPA 170.1 and TCEQ SOP V1	00010	NA*	NA	NA	NA	Field
Secchi Depth	meters	water	TCEQ SOP V1	00078	NA*	NA	NA	NA	Field
Days since last significant rainfall	days	NA	TCEQ SOP V1	72053	NA*	NA	NA	NA	Field
Total water depth	meters	water	TCEQ SOP V2	82903	NA*	NA	NA	NA	Field
Flow	cfs	water	TCEQ SOP V1	00061	NA*	NA	NA	NA	Field
Flow measurement method	1-gage 2-electric 3-mechanical 4-weir/flume 5-doppler	water	TCEQ SOP V1	89835	NA*	NA	NA	NA	Field
Flow severity	1-no flow, 2-low, 3-normal, 4-flood, 5-high, 6-dry	water	TCEQ SOP V1	01351	NA*	NA	NA	NA	Field
Air Temperature	B C	Air	TCEQ SOP	00020	NA*	NA	NA	NA	Field
Wind Direction	1-north, 2-south, 3-east, 4-west, 5-northeast, 6-southeast, 7-northwest, 8-southwest	Air	TCEQ SOP	89010	NA*	NA	NA	NA	Field
Wind Intensity	1-calm, 2-slight, 3-moderate, 4-strong	Air	TCEQ SOP	89965	NA*	NA	NA	NA	Field
Present Weather	1-clear, 2-partly cloudy, 3-cloudy, 4-rain	Air	TCEQ SOP	89966	NA*	NA	NA	NA	Field
Water Color	1-brown, 2-reddish, 3-green, 4-black, 5-clear, 6-other	Water	TCEQ SOP	89969	NA*	NA	NA	NA	Field

PARAMETER	UNITS	MATRIX	METHOD	Parameter Code	AWRL	Limit of Quantitation (LOQ)	PRECISION (RPD of LCS/LCSD)	BIAS (%Rec. of LCS)	Lab
Water Odor	1-sewage, 2-oily/ chemical, 3-rotten eggs, 4-musky, 5-fishy, 6-none, 7-other	Air	TCEQ SOP	89971	NA*	NA	NA	NA	Field
Water Surface	1-calm, 2-ripples, 3-waves, 4-white caps	Air	TCEQ SOP	89968	NA*	NA	NA	NA	Field
Turbidity	1-low, 2-medium, 3-high	Air	TCEQ SOP	88842	NA*	NA	NA	NA	Field
Tide Stage, marine only	1-low, 2-falling, 3-slack, 4-rising, 5-high	water	TCEQ SOP	89972	NA*	NA	NA	NA	Field
Rainfall in 1 day prior to sample	inches	NA	TCEQ SOP	82553	NA*	NA	NA	NA	Field
Rainfall in 7 days prior to sample	inches	NA	TCEQ SOP	82554	NA*	NA	NA	NA	Field
TSS	mg/L	water	SM2540D	00530	4	1	20	65-135	LCRA
E. coli	CFU/100 mL	water	EPA 1103.1	31648	1	1	0.5*	NA	A&M-CC
Enterococcus	CFU /100 mL	water	EPA 1600	31649	1	1	0.5*	NA	A&M-CC
Fecal Coliform	CFU /100 mL	water	SM 9222 D	31616	1	1	0.5*	NA	A&M-CC
Turbidity	NTU	water	SM 2130B	82079	0.5	0.5	20	80-120	LCRA

* Based on a range statistic as described in Standard Methods, 21th Edition, Section 9020-B, "Quality Assurance/Quality Control - Intralaboratory Quality Control Guidelines." This criterion applies to bacteriological duplicates with concentrations >10 MPN/100mL or 10 organisms/100mL.

References for Table A7.1:

EPA "Methods for Chemical Analysis of Water and Wastes," Manual #EPA-600/4-79-020

American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), "Standard Methods for the Examination of Water and Wastewater," 20th Edition, 1998.

TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2003 (RG-415).

American Society for Testing and Materials (ASTM) Annual Book of Standards, Vol. 11.02

Ambient Water Reporting Limits (AWRLs)

The AWRL establishes the reporting specification at **or below** which data for a parameter must be reported to be compared with freshwater screening criteria. The AWRLs specified in Table A7.1 are TCEQ CRP program-defined reporting specifications for each analyte. The limit of quantitation (formerly known as the reporting limit) is the minimum level concentration, or quantity of a target variable (e.g., target analyte) that can be reported with a specific degree of confidence.

- The laboratory's Limit of Quantitation (LOQ) for each analyte must be at **or below** the AWRL as a matter of routine practice

- The laboratory must demonstrate its ability to quantitate at its LOQ for each analyte by running an LOQ check standard each time that samples are analyzed.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria are provided in Section B5.

Precision
Precision is the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. It is a measure of agreement among replicate measurements of the same property, under prescribed similar conditions, and is an indication of random error.

Field splits are used to assess the variability of sample handling, preservation, and storage, as well as the analytical process, and are prepared by splitting samples in the field. Control limits for field splits are defined in Section B5.

Laboratory precision is assessed by comparing replicate analyses of laboratory control standards in the sample matrix (e.g. deioinized water, commercially available tissue) or sample/duplicate pairs in the case of bacterial analysis. Precision results are compared against measurement performance specifications and used during evaluation of analytical performance. Program-defined measurement performance specifications for precision are defined in Table A7.1.

Bias
Bias is a statistical measurement of correctness and includes multiple components of systematic error. A measurement is considered unbiased when the value reported does not differ from the true value. Bias is determined through the analysis of laboratory control standards and LOQ check Standards prepared with verified and known amounts of all target analytes in the sample matrix (e.g. deioinized water, commercially available tissue) and by calculating percent recovery. Results are compared against measurement performance specifications and used during evaluation of analytical performance. Program-defined measurement performance specifications for bias are specified in Table A7.1.

Representativeness
Data collected under this project will be considered representative of ambient water quality for dry/low flow sampling conditions and of stormwater (high flow) during wet/runoff conditions. Representativeness is a measure of how accurately a monitoring program reflects the actual water quality conditions typical of receiving waters. The representativeness of the data is dependent on 1) the sampling locations, 2) the number of samples collected, 3) the number of years, the seasons and weather conditions when sampling is performed, 4) the number of depths sampled, and 5) the sampling procedures. Site selection procedures will assure that the measurement data represent the conditions at the site. The goal for meeting total representation of the water body and watershed is tempered by the availability of time and funding. Representativeness will be measured with the completion of sample collection in accordance with the approved QAPP.

Comparability

Confidence in the comparability of data sets for this project and for water quality assessments is based on the commitment of project staff to use only approved sampling and analysis methods and QA/QC protocols in accordance with quality system requirements and as described in this QAPP. Comparability is also guaranteed by reporting data in standard units, by using accepted rules for rounding figures, and by reporting data in a standard format as specified in Section B10.

Completeness

The completeness of the data is basically a relationship of how much of the data is available for use compared to the total potential data. Ideally, 100% of the data should be available. However, the possibility of unavailable data due to accidents, insufficient sample volume, broken or lost samples, etc. is to be expected. Therefore, it will be a general goal of the project that 90% data completion is achieved.

A8 Special Training/Certification

New field personnel receive training in proper sampling and field analysis. Before actual sampling or field analysis occurs, they will demonstrate to the QA Officer (or designee) their ability to properly calibrate field equipment and perform field sampling and analysis procedures. Field personnel training is documented and retained in the personnel file and will be available during a monitoring systems audit.

Contractors and subcontractors must ensure that laboratories analyzing samples under this QAPP meet the requirements contained in Section 5.4.4 of the National Environmental Laboratory Accreditation Conference (NELAC) Standard.

A9 DOCUMENTS AND RECORDS

The documents and records that describe, specify, report, or certify activities are listed.

Table A9.1 Project Documents and Records

Document/Record	Location	Retention (yrs)	Format
QAPPs, amendments and appendices	TSSWCB, NRA	**7**	**Paper, electronic**
Field SOPs	NRA	**7**	**Paper, electronic**
Laboratory QA Manuals	TAMU-CC, LCRA	**5**	**Paper**
Laboratory SOPs	TAMU-CC, LCRA	**5**	**Paper**
QAPP distribution documentation	NRA	**7**	**Paper, electronic**
Field staff training records	NRA, TAMU-CC, LCRA	**5**	**Paper**
Field equipment calibration/maintenance logs	NRA	**7**	**Paper**
Field instrument printouts	NRA	**7**	**Paper**
Field notebooks or data sheets	NRA	**7**	**Paper**
Chain of custody records	NRA	**7**	**Paper**
Laboratory calibration records	TAMU-CC, LCRA	**5**	**Paper**
Laboratory instrument printouts	TAMU-CC, LCRA	**5**	**Paper, electronic**
Laboratory data reports/results	TAMU-CC, LCRA, NRA	**5**	**Paper, electronic**
Laboratory equipment maintenance logs	TAMU-CC, LCRA	**5**	**Paper**
Corrective Action Documentation	TAMU-CC, LCRA, NRA	**5**	**Paper**

Laboratory Test Reports

Test/data reports from the laboratory must document the test results clearly and accurately. Routine data reports are consistent with the NELAC Standard (Section 5.5.10) and include the information necessary for the interpretation and validation of data. The format for reporting data and the procedures are provided.

1. Sample results
2. Units of measurement
3. Sample matrix
4. Dry weight or wet weight (as applicable)
5. Station information
6. Date and time of collection
7. LOQ and LOD (formerly referred to as the reporting limit and the method detection limit, respectively), and qualification of results outside the working range (if applicable)
8. Certification of NELAC compliance on a result by result basis

Electronic Data

Data will be submitted electronically to the TSSWCB in a file format conducive to entry into the SWQM-IS database. A completed Data Summary (see example in Appendix E) will be submitted with each data submittal. Data from TAMU-CC/EML are received by NRA electronically via email and as hard copy. Data from LCRA ELS are received electronically, via email.

B1 Sampling Process Design

See Appendix B for sampling process design information and monitoring tables associated with data collected under this QAPP.

B2 Sampling Methods

Field Sampling Procedures
Field sampling will be conducted according to procedures documented in the *TCEQ Surface Water Quality Monitoring Procedures Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2003.(RG-415) and Volume 2: Methods for Collecting and Analyzing Biological Community and Habitat Data* (*RG-416)*. Additional aspects outlined in Section B below reflect specific requirements for sampling under the *SWQM for Copano Bay TMDL* and/or provide additional clarification, i.e.—sample volume, container types, minimum sample volume, preservation requirements, and holding time requirements.

Table 6Sample Storage, Preservation and Handling Requirements

Parameter	Matrix	Container**	Preservation	Sample Vol. (mL)	Holding Time
Bacteriological					
E. coli	Water	1	* cool to 4 ^{o} C	1000	8 hours
Enterococcus	Water	1	* cool to 4 ^{o} C	1000	8 hours
Fecal coliform	Water	1	* cool to 4 ^{o} C	1000	8 hours
Routine Chemical					
Turbidity	Water	2	* cool to 4 ^{o} C	250	48 hrs
TSS	Water	2	* cool to 4 ^{o} C	600	7 days

* Preservation performed immediately upon collection (within 15 minutes)
** See Table B2.2 below for container description.

Sample Containers
Sample containers for all monitoring are provided by corresponding laboratories. Bacteriological sample bottles provided by TAMU-CC/EML are pre-washed and autoclaved by the TAMU-CC/EML staff. Chemical sample containers provided by LCRA ELS are delivered to NRA and are new sterilized containers.

Table B2.2 Sample Containers

Sampling Containers			
Container #	**Bottle Description**	**Treatment & Preservation**	**Lab**
1	1000mL polypropylene bottle, autoclaved	None	TAMU-CC
2	1000mL polyethylene bottle	None	LCRA

Processes to Prevent Contamination
Procedures outlined in the *TCEQ Surface Water Quality Monitoring Procedures* outline the necessary steps to prevent contamination of samples. These include direct collection into sample containers, when possible. Field QC samples (identified in Section B5) are collected to verify that contamination has not occurred.

Documentation of Field Sampling Activities

Field sampling activities are documented on field data sheets as presented in Appendix C. The following will be recorded for all visits:

1. Station ID
2. Sampling Date
3. Location
4. Sampling depth
5. Sampling time
6. Sample collector's name/signature
7. Values for all field parameters
8. Detailed observational data, including:
    a) water appearance
    b) weather
    c) biological activity
    d) unusual odors
    e) pertinent observations related to water quality or stream uses (e.g., exceptionally poor water quality conditions/standards not met; stream uses such as swimming, boating, fishing, irrigation pumps, etc.)
    f) watershed or instream activities (events impacting water quality, e.g., bridge construction, etc.)
    g) specific sample information (number of sediments grabs, type/number of fish in a tissue sample, etc.)
    h) missing parameters (i.e., when a scheduled parameter or group of parameters is not collected)

Recording Data

For the purposes of this section and subsequent sections, all field and laboratory personnel follow the basic rules for recording information as documented below:

1. Legible writing in indelible ink;
2. Changes should be made by crossing out original entries with a single line, entering the changes, and initialing and dating the corrections;
3. Close-out on incomplete pages with an initialed and dated diagonal line.

Deficiencies, Nonconformances and Corrective Action Related to Sampling Requirements

Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP or other applicable documents. Nonconformances are deficiencies which affect data quantity and/or quality and render the data unacceptable or indeterminate. Deficiencies related to sampling methods requirements include, but are not limited to, such things as sample container, volume, and preservation variations, improper/inadequate storage temperature, holding-time exceedances, and sample site adjustments.

Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff and reported to the appropriate field or laboratory supervisor who will notify the NRA Project

Manager/QAO of the potential nonconformance. The NRA Project Manger/QAO will initiate a Nonconformance Report (NCR) to document the deficiency.

The NRA Project Manager/QAO (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the NCR will be completed accordingly and the NCR closed. If it is determined a nonconformance does exist, the NRA Project Manager/QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by the contractor QAO by completion of a Corrective Action Report (CAR).

CARs document: root cause(s); impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and the means by which completion of each corrective action will be documented. CARs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TSSWCB immediately both verbally and in writing.

B3 Sample Handling and Custody

Sample Tracking
Proper sample handling and custody procedures ensure the custody and integrity of samples beginning at the time of sampling and continuing through transport, sample receipt, preparation, and analysis.

A sample is in custody if it is in actual physical possession or in a secured area that is restricted to authorized personnel. The Chain-of-Custody (COC) form is a record that documents the possession of the samples from the time of collection to receipt in the laboratory. The following information concerning the sample is recorded on the COC form (See Appendix D). The following list of items matches the COC form in Appendix D.

1. Date and time of collection
2. Site identification
3. Sample matrix
4. Number of containers
5. Preservative used or if the sample was filtered
6. Analyses required
7. Name of collector
8. Custody transfer signatures and dates and time of transfer
9. Bill of lading

Sample Labeling
Sample containers provided by LCRA ELS include an adhesive label for identification. An indelible marker is used to record information on the container label. Sample containers provided by TAMU-CC/EML are labeled with the site number only; all other information is noted on the COC form. Label information includes:

1. Site identification
2. Date and time of collection
3. Preservative added, if applicable
4. Sample type [i.e., analysis(es) to be performed]

Sample Handling
The objective of sampling is to collect a portion of material that accurately represents the material sampled. To ensure that the sample does not deteriorate or become contaminated, proper techniques need to be followed. Standard operating sampling procedures will be consistent with those described in the *TCEQ Surface Water Quality Monitoring Procedures Manual* (2003).

Sampling will be performed by NRA as follows:

> All bottles, which will be used by NRA and TCEQ, will be supplied to the NRA by LCRA-ELS and TAMU-CC/EML. Field personnel will collect samples in the designated locations in sampling containers as outlined in Table B2.1. Samples will be immediately placed on ice in the field.

NRA will schedule sampling activities such that the samples can be delivered to the laboratory and be processed within the maximum holding time. The field supervisor is responsible for ensuring that proper equipment is available and that all field staff is educated in proper sampling methods. Documentation of preservation and other sampling information will be found on COC forms and field data sheets. These will accompany the samples and be submitted to the laboratory.

Failures involving sampling and the associative corrective actions will be noted on the field data sheet or COC form (Appendix D). It is the NRA Project Manager/QAO's responsibility to summarize in a memorandum all deficiencies encountered and the corrective actions taken during an event.

Conventional samples collected by NRA will be sent to LCRA ELS, via bus delivery (Corpus Christi, Texas to Austin, Texas) and bacteriological samples will be hand delivered to TAMU-CC/EML.

When sample containers are sent by common carrier (i.e., bus or express mail) the following shipping procedures will be followed:

> Samples will be packaged to ensure that the samples and the COC forms will arrive at the laboratory intact and together. The COC form will be signed as relinquished by the person having custody of the sample, then sealed inside the sample container. A bill of lading or waybill document issued by the transportation carrier to the shipper will serve as the custody documentation for the shipment during the time that the samples are entrusted to the carrier. The bill of lading will acknowledge that the transporter has received the samples which are bound for a particular destination, and will state the terms in which these samples are to be carried. If the sample container seal is broken prior to delivery by the carrier, then chain of custody of that sample will be considered lost despite the presence of the bill of lading.
>
> Copies of the bill of lading will become part of the chain of custody for samples that are successfully delivered, and will be retained as part of the permanent documentation of the project. The bill of lading will be kept attached to the other custody documents, and the unique identifying information from the bill of lading (tracking number, etc.) also be recorded on the COC form to correlate the two documents.

The LCRA ELS will handle all samples according to procedures provided under section B3 of their current CRP QAPP.

The TAMU-CC/EML laboratory will use the following procedures to handle water samples:

1. Upon receipt, samples which are delivered to TAMU-CC/EML are checked against the COC to confirm sample station identification number, the time and date sample was taken to insure holding times are not exceeded, proper labeling on sample bottles, and proper preservation was used where needed. Any discrepancies are reported to TAMU-CC/EML Coordinator and subsequently, NRA Project Manager.

2. If there are no discrepancies, or when all discrepancies have been resolved, the COC is then signed, copied, and returned. Copies of the COCs are kept with samples as they proceed through the analysis process.

3. Samples are logged in and tracked by sample station identification number.

4. Samples are placed in proper storage to insure proper preservation of samples until analysis is completed.

5. All work performed on each sample is recorded in logbooks and analysis sheets. Sample station identification number, collection date, collection time, process date, and process time are all recorded and tracked.

6. All documentation is dated and initialed by each analyst throughout each stage of analysis procedure.

7. All data sheets, log sheets, and copies of COCs are delivered with laboratory analysis.

Deficiencies, Nonconformances and Corrective Action Related to Chain-of-Custody

Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP or other applicable documents. Nonconformances are deficiencies which affect data quantity and/or quality and render the data unacceptable or indeterminate. Deficiencies related to chain-of-custody include but are not limited to delays in transfer, resulting in holding time violations; incomplete documentation, including signatures; possible tampering of samples; broken or spilled samples, etc.

Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff and reported to the appropriate field or laboratory supervisor who will notify the NRA Project Manager/QAO of the potential nonconformance. The NRA QAO will initiate an NCR to document the deficiency.

The NRA Project Manager/QAO (and other affected individuals/organizations) will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality, and is not a valid nonconformance, the NCR will be completed accordingly and the NCR closed. If it is determined a nonconformance does exist, the NRA Project Manager/QAO will determine the nature of the nonconforming activity or item and necessary corrective action(s). Results will be documented by the NRA QAO with the completion of a CAR.

CARs document the root cause(s), impact(s), specific corrective action(s) to address the deficiency, action(s) to prevent recurrence, individual(s) responsible for each action, the timetable for completion of each action, and the means by which completion of each corrective action will be documented. CARs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TSSWCB immediately both verbally and in writing.

B4 ANALYTICAL METHODS

The analytical methods, associated matrices, and performing laboratories are listed in Table A7.1. The authority for analysis methodologies under the SWQM for Copano Bay TMDL is derived from the TSWQS (TAC §§307.1-307.10) in that data generally are generated for comparison to those standards and/or criteria. The Standards state that procedures for laboratory analysis will be in accordance with the most recently published edition of *Standard Methods for the Examination of Water and Wastewater*, the latest version of the *TCEQ Surface Water Quality Monitoring Procedures*, 40 CFR 136, or other reliable procedures.

Laboratories collecting data under this QAPP are compliant with the NELAC Standard. Copies of Laboratory QMs and SOPs are available for review by the TSSWCB.

Standards Traceability
All standards used in the field and laboratory are traceable to certified reference materials. Standards preparation is fully documented and maintained in a standards log book. Each documentation includes information concerning the standard identification, starting materials, including concentration, amount used and lot number; date prepared, expiration date and preparer's initials/signature. The reagent bottle is labeled in a way that will trace the reagent back to preparation.

Deficiencies, Nonconformances and Corrective Action Related to Analytical Methods
Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP or other applicable documents. Nonconformances are deficiencies which affect quantity and/or quality and render the data unacceptable or indeterminate. Deficiencies related to field and laboratory measurement systems include but are not limited to instrument malfunctions, blank contamination, quality control sample failures, etc.

Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff and reported to the appropriate field or laboratory supervisor who will notify the NRA Project Manager/QAO of the potential nonconformance. The NRA QAO will initiate an NCR to document the deficiency.

The NRA Project Manager/QAO (and other affected individuals/organizations) will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the NCR will be completed accordingly and the NCR closed. If it is determined a nonconformance does exist, the NRA Project Manager/QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s). Results will be documented by the NRA QAO with the completion of a CAR.

CARs document the root cause(s), impact(s), specific corrective action(s) to address the deficiency, action(s) to prevent recurrence, individual(s) responsible for each action, the timetable for completion of each action, and the means by which completion of each corrective action will be documented. CARs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TSSWCB immediately both verbally and in writing.

B5 Quality Control

Method Specific QC requirements
Additional QC samples are run (i.e.—sample duplicates, surrogates, internal standards, continuing calibration samples, interference check samples) as specified in the methods. The requirements for these samples, their acceptance criteria or instructions for establishing criteria, and corrective actions are method-specific.

Sampling Quality Control Requirements and Acceptability Criteria
The minimum Field QC Requirements are outlined in the *TCEQ Surface Water Quality Monitoring Procedures.* Specific requirements are outlined below. Field QC sample results are submitted with the laboratory data report (see Section A9).

Field Split - A field split is a single sample subdivided by field staff immediately following collection and submitted to the laboratory as two separately identified samples according to procedures specified in the *SWQM Procedures*. Split samples are preserved, handled, shipped, and analyzed identically and are used to assess variability in all of these processes. Field splits apply to conventional samples only. According to procedures specified in the *TCEQ SWQM Procedures,* field splits are to be submitted with every tenth sample. If less than 10 samples are collected in a month, submit one set of splits per month.

The precision of field split results is calculated by relative percent difference (RPD) using the following equation:

$$RPD = (X1-X2)/((X1+X2)/2))$$

A 20% RPD criteria will be used to screen field split results as a possible indicator of excessive variability in the sample handling and analytical system. If it is determined that elevated quantities of analyte (i.e., > 5 times the LOQ) were measured and analytical variability can be eliminated as a factor, than variability in field split results will primarily be used as a trigger for discussion with field staff to ensure samples are being handled in the field correctly. Some individual sample results may be invalidated based on the examination of all extenuating information. The information derived from field splits is generally considered to be event specific and would not normally be used to determine the validity of an entire batch; however, some batches of samples may be invalidated depending on the situation. Professional judgment during data validation will be relied upon to interpret the results and take appropriate action. The qualification (i.e., invalidation) of data will be documented on the Data Summary. Deficiencies will be addressed as specified in this section under Deficiencies, Nonconformances, and Correction Action related to Quality Control.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria
QC samples, other than those specified later this section, are run (i.e.—sample duplicates, surrogates, internal standards, continuing calibration samples, interference check samples, positive control, negative control, and media blank) as specified in the methods. The requirements for these samples, their acceptance criteria or instructions for establishing criteria, and corrective actions are method-specific.

Detailed laboratory QC requirements and corrective action procedures are contained within the individual laboratory quality manuals (QMs). The minimum requirements that all participants abide by are stated below. Lab QC sample results are submitted with the laboratory data report (see Section A9).

Limit of Quantitation (LOQ) – The laboratory will analyze a calibration standard (if applicable) at the LOQ on each day samples are analyzed. Calibrations including the standard at the LOQ will meet the calibration requirements of the analytical method or corrective action will be implemented.

LOQ Check Standard – An LOQ check standard consists of a sample matrix (i.e.—deionized water, sand, commercially available tissue) free from the analytes of interest spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is used to establish intra-laboratory bias to assess the performance of the measurement system at the lower limits of analysis. The LOQ check standard is spiked into the sample matrix at a level less than or near the LOQ for each analyte each time that CRP samples are run.

The LOQ check standard is carried through the complete preparation and analytical process. LOQ Check Standards are run at a rate of one per analytical batch. A batch is defined as samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 20 environmental samples.

The percent recovery of the LOQ check standard is calculated using the following equation in which %R is percent recovery, SR is the sample result, and SA is the reference concentration for the check standard:

$$\%R = SR/SA * 100$$

Measurement performance specifications are used to determine the acceptability of LOQ Check Standard analyses as specified in Table A7.1.

Laboratory Control Sample (LCS) - An LCS consists of a sample matrix (i.e.—deionized water), free from the analytes of interest spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst specific precision and bias to assess the performance of all or a portion of the measurement system. The LCS is spiked into the sample matrix at a level less than or near the mid point of the calibration curve or LOQ for each analyte. In cases of test methods with very long lists of analytes, LCSs are prepared with all the target analytes and not just a representative number, except in cases of organic analytes with multipeak responses.

The LCS is carried through the complete preparation and analytical process. LCSs are run at a rate of one per analytical batch. A batch is defined as samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 20 environmental samples.

Results of LCSs are calculated by percent recovery (%R), which is defined as 100 times the measured concentration, divided by the true concentration of the spiked sample.

The following formula is used to calculate percent recovery, where %R is percent recovery; SR is the measured result; and SA is the true result:

$$\%R = SR/SA * 100$$

Measurement performance specifications are used to determine the acceptability of LCS analyses as specified in Table A7.1.

Laboratory Duplicates - A laboratory duplicate is prepared by taking aliquots of a sample from the same container under laboratory conditions and processed and analyzed independently. A laboratory control sample duplicate (LCSD) is prepared in the laboratory by splitting aliquots of an LCS. Both samples are carried through the entire preparation and analytical process. LCSDs are used to assess precision and are performed at a rate of one per batch. A batch is defined as samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 20 environmental samples.

For most parameters, precision is calculated by the relative percent difference (RPD) of LCS duplicate results as defined by 100 times the difference (range) of each duplicate set, divided by the average value (mean) of the set. For duplicate results, X_1 and X_2, the RPD is calculated from the following equation.

$$RPD = (X_1 - X_2)/\{(X_1+X_2)/2\} * 100$$

A bacteriological duplicate is considered to be a special type of laboratory duplicate and applies when bacteriological samples are run in the field as well as in the lab. Bacteriological duplicate analyses are performed on samples from the sample bottle on a 10% basis. Results of bacteriological duplicates are evaluated by calculating the logarithm of each result and determining the range of each pair.

Measurement performance specifications are used to determine the acceptability of duplicate analyses as specified in Table A7.1. The specifications for bacteriological duplicates in Table A7.1 apply to samples with concentrations > 10 org./100mL.

Matrix spike (MS) - Matrix spikes are prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Percent recovery of the known concentration of added analyte is used to assess accuracy of the analytical process. The spiking occurs prior to sample preparation and analysis. Spiked samples are routinely prepared and analyzed at a rate of 10% of samples process, or one per batch whichever is greater. A batch is defined as samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 20 environmental samples. The information from these controls is sample/matrix specific and is not used to determine the validity of the entire batch. The MS is spiked at a level less than or equal to the midpoint of the calibration or

analysis range for each analyte. Percent recovery (%R) is defined as 100 times the observed concentration, minus the sample concentration, divided by the true concentration of the spike.

The results from matrix spiked are primarily designed to assess the validity of analytical results in a given matrix and are expressed as percent recovery (%R). The laboratory shall document the calculation for %R. The percent recovery of the matrix spike is calculated using the following equation in which %R is the percent recovery, SSR is the observed spiked sample concentration, SR is the sample result, and SA the reference concentration of the spike added:

$$\%R = (SSR - SR)/SA * 100$$

Measurement performance specifications for matrix spikes are not specified in this document.

The results are compared to the acceptance criteria as published in the mandated test method. Where there are no established criteria, the laboratory shall determine the internal criteria and document the method used to establish the limits. For matrix spike results outside established criteria, corrective action shall be documented or the data reported with appropriate data qualifying codes.

Method blank - A method blank is a sample of matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as the samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. The method blank is carried through the complete sample preparation and analytical procedure. The analysis of method blanks should yield values less than the LOQ. For high-level analyses, the blank value should be less than 5% of the lowest value of the batch, or correction action will be implemented.

Deficiencies, Nonconformances and Corrective Action Related to Quality Control

Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP. Nonconformances are deficiencies which affect data quantity and/or quality and render the data unacceptable or indeterminate. Deficiencies related to quality control include but are not limited to field and laboratory quality control sample failures.

Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff and reported to the appropriate field or laboratory supervisor who will notify the NRA Project Manager/QAO of the potential nonconformance. The NRA QAO will initiate an NCR to document the deficiency.

The NRA Project Manager/QAO (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the NCR will be completed accordingly and the NCR closed. If it is determined a nonconformance does exist, the NRA Project Manager/QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by the contractor QAO by completion of a CAR.

CARs document: root cause(s); impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and, the means by which completion of each corrective action will be documented. CARs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TSSWCB immediately both verbally and in writing.

B6 Instrument/Equipment Testing, Inspection and Maintenance

All sampling equipment testing and maintenance requirements are detailed in the *TCEQ Surface Water Quality Monitoring Procedures*. Sampling equipment is inspected and tested upon receipt and is assured appropriate for use. Equipment records are kept on all field equipment and a supply of critical spare parts is maintained.

All laboratory tools, gauges, instrument, and equipment testing and maintenance requirements are contained within laboratory QM(s).

B7 INSTRUMENT CALIBRATION AND FREQUENCY

Field equipment calibration requirements are contained in the *TCEQ Surface Water Quality Monitoring Procedures*. Post-calibration error limits and the disposition resulting from error are adhered to. Data not meeting post-error limit requirements invalidate associated data collected subsequent to the pre-calibration and are not submitted to the TSSWCB.

Detailed laboratory calibrations are contained within the QM(s).

B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

The procurement of supplies, equipment and services is controlled to ensure that specifications are met for the high quality and reliability required for each field and laboratory task. All field sampling supplies and consumables are purchased by the NRA Field Supervisor who is responsible for evaluating the need and quality required for the particular item.

Refer to the LCRA ELS, and TAMU-CC/EML QAMs for laboratory related supplies and consumables procedures.

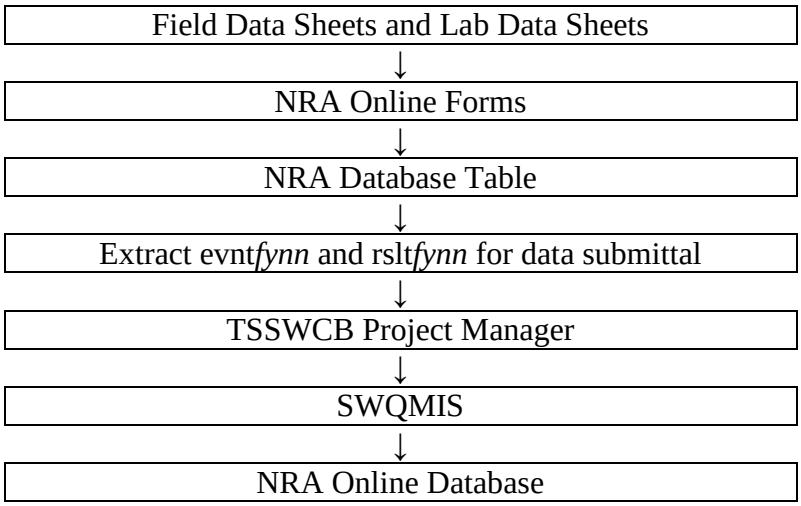
B9 NON-DIRECT MEASUREMENTS

Sampling will take place on a scheduled basis, independent of flow and weather, tentatively planned for the second and fourth weeks of each month. Flow for sites located near USGS gauge stations will be recorded based on the gauge reading. Flow at other sites will be estimated based on water height and channel configuration. A flow severity of low, medium, or high, recent precipitation amounts, and days since last significant precipitation will also be recorded. This information will be used to determine if a sampling event was a runoff event or dry weather event. NRA will transfer monitoring data to TSSWCB for inclusion in the TCEQ surface water quality monitoring database. Data will be transferred in the correct format using the TCEQ file structure, along with a completed Data Summary, as described in the most recent version of TCEQ Surface Water Quality Monitoring Data Management Reference Guide.

B10 DATA MANAGEMENT

Data Management Process
Data from LCRA ELS is received electronically via email. Data from the TAMU-CC/EML is received electronically via email and as hardcopy. Along with the field data, the Field staff enters information into a database table via an online data entry form. The form contains a list of stations for each parameter to indicate whether or not that parameter is reported for a specific station.

The data will be supplied to the TSSWCB Project Manager as ASCII delimited text files in the Event/Result file formats as described in the *TCEQ Surface Water Quality Monitoring Data Management Reference Guide*. The files will be named evnt*fynn*.txt and rslt*fynn*.txt where *fy* denotes the fiscal years and *nn* denotes the sampling event, i.e. d1=first dry event or w2=second wet event.



Data Errors and Loss
Time of lab analysis is compared to holding times for all parameters. In the event that a holding time is not met, the accompanying narrative is reviewed for an explanation and/or validity of the reported data. This information is entered into the comment field of the event table and the data exceeding the holding times excluded from the reported data set, if applicable.

To detect and correct errors prior to submission to TSSWCB, the scripts that convert the data entered in the online forms check the entered value against the storet codes minimum and maximum accepted values. In the event that the data are outside the range, the script returns an error message instructing the user to either re-enter the data or to place a "1" in an associated box that is equivalent to the "Verify_flg" field of the results table. Date and time entries must also be in valid formats for the scripts to process the data. A report of the records that were added to the table is displayed. The report is printed and used to review the data against the field and laboratory data sheets.

Record Keeping and Data Storage
All hardcopy field and lab data sheets are stored in files associated with the quarter in which the sampling occurred. The database is located on a Windows NT server housed in San Antonio, Texas. The water quality database consists of three tables: *sparameters*, which contains parameter code

information; *swqm*, which contains information on all sampling stations within NRA's area of responsibility; and *results*, which contains all the sampling event and result information and data.

The NRA Data Manager backs up the water quality database, web pages, and scripts monthly, on or about the first of each month. The database tables are copied to text files and compressed. Listings of the current month's updated records for the individual segments, the web pages and scripts are also copied and compressed. These files are copied to a network drive that is backed up daily and monthly to a CD-ROM. The CDs are stored in a fireproof safe on-site.

Table B10.1 Data Handling, Hardware, and Software Requirements

SERVER HARDWARE #1:	Dell Server
SERVER DATABASE SOFTWARE #1:	Microsoft-IIS/6.0
SERVER SOFTWARE #1:	Windows NT NS1 5.2 build 3790
SERVER_PROTOCOL #1:	HTTP/1.1
SERVER HARDWARE #2:	LSI Pentium
SERVER DATABASE SOFTWARE #2:	MySQL build 3.23.58
SERVER SOFTWARE #2:	Linux 9.0
SERVER_PROTOCOL #2:	HTTP/1.1
PROGRAMMING LANGUAGE SUPPORT:	CGI-PERL, JAVASCRIPT, HTML, XHTML, PHP, SQL, BASH, JAVA, and ACTIVE PERL.
DATABASE SUPPLEMENTAL SOFTWARE APPLICATIONS:	SECURE SHELL, SECURE FTP, WS_FTP(LE), Notepad, MS WORD, OUTLOOK Express, WINZIP9.0, Roxio Easy CD Creater 5, CRONTAB and MS OUTLOOK.
DATABASE SUPPLEMENTAL GRAPICS SOFTWARE APPLICATIONS:	JASC Paint Shop Pro 8, JASC ANIMATION, and JASC Animation Shop.
MIDDLEWARE	DBI,/DBD, MY_SQL Connect, CGI/FastCGI, Mozilla/4.0, MSIE 6.0, Netscape7.0, Opera, and FireFox.
DATABASE COMPUTER SUPPLEMENTAL HARDWARE/SOFTWARE:	Dell Dimension 4300-Intel Pentium 4(1.6GHz)/Windows 2000 5.00.2195 SP4, Dell OPtiPlexGX270-Intel Pentium 4(2.8GHz)/Windows XP 2002 SP2, and Dell Dimension 8100-Intel Pentium 4(1.7GHz)/Windows 2000 5.00.2195 SP4
DATABASE PRINTER SUPPLEMENTAL HARDWARE/SOFTWARE:	HP Color Laser Jet 4500DN

Information Resource Management Requirements

Data will be managed in accordance with the *TCEQ Surface Water Quality Monitoring Data Management Reference Guide* and applicable NRA information resource management policies.

C1 ASSESSMENTS AND RESPONSE ACTIONS

The following table presents the types of assessments and response actions for data collection activities applicable to the QAPP.

Table C1.1 Assessments and Response Requirements

Assessment Activity	Approximate Schedule	Responsible Party	Scope	Response Requirements
Status Monitoring Oversight, etc.	Continuous	NRA	Monitoring of the project status and records to ensure requirements are being fulfilled	Report to TSSWCB in Quarterly Report
Monitoring Systems Audit of Planning Agency	At least once per life of project-TSSWCB	TSSWCB	Field sampling, handling and measurement; facility review; and data management as they relate to this QAPP	30 days to respond in writing to the TSSWCB to address corrective actions
Laboratory Inspection	At least once per life of project-TSSWCB	TSSWCB Laboratory Inspector	Analytical and quality control procedures employed at the laboratory and the contract laboratory.	30 days to respond in writing to the TSSWCB to address corrective actions

Corrective Action

The NRA Project Manager is responsible for implementing and tracking corrective action resulting from audit findings outlined in the audit report. Records of audit findings and corrective actions are maintained by both the TSSWCB and the NRA Project Manager. Audit reports and corrective action documentation will be submitted to the TSSWCB with the Progress Report.

If audit findings and corrective actions cannot be resolved, then the authority and responsibility for terminating work are specified in the TSSWCB QMP and in agreements in contracts between participating organizations.

C2 REPORTS TO MANAGEMENT

Reports to NRA Project Management
QA issues will be reported in writing (e-mail) to the NRA Project Manager as issues arise.

The Project Manager for the NRA is charged with the responsibility to report the status of implementation and application of the quality assurance procedures described in this QAPP and thereby the status of data quality. It is imperative that the Project Manager is properly informed of any quality assurance problems encountered and assists in the development and implementation of corrective actions. This information will be provided to the Project Manager by the NRA Data Manager and/or Field Personnel. These reports will include laboratory analysis quality assurance summaries and field QC results. These reports will be provided to the NRA Project Manager/QAO as needed prior to the transfer of the database to the TSSWCB. Other reports as needed include, but are not limited to, corrective action forms, correspondence, etc., describing corrective actions or implementation of new processes to ensure that quality data are produced.

Reports to TSSWCB Project Management
All reports detailed in this section are contract deliverables and are transferred to the TSSWCB in accordance with contract requirements.

Progress Report - Summarizes NRA activities for each task; reports monitoring status, problems, delays, and corrective actions; and outlines the status of each task's deliverables.

D1 DATA REVIEW, VERIFICATION, AND VALIDATION

All field and laboratory data will be reviewed and verified for integrity and continuity, reasonableness, and conformance to project requirements, and then validated against the project objectives and measurement performance specifications which are listed in Section A7. Only those data which are supported by appropriate quality control data and meet the measurement performance specifications defined for this project will be considered acceptable.

D2 VERIFICATION AND VALIDATION METHODS

All field and laboratory data will be reviewed, verified and validated to ensure they conform to project specifications and meet the conditions of end use as described in Section A7 of this document.

Data review, verification, and validation will be performed using self-assessments and peer and management review as appropriate to the project task. The data review tasks, to be performed by field and laboratory staff, are listed in the first two sections of Table D2, respectively. Potential errors are identified by examination of documentation and by manual *(or computer-assisted)* examination of corollary or unreasonable data. If a question arises or an error is identified, the manager of the task responsible for generating the data is contacted to resolve the issue. Issues which can be corrected are corrected and documented. If an issue cannot be corrected, the task manager consults with higher level project management to establish the appropriate course of action, or the data associated with the issue are rejected. Field and laboratory reviews, verifications, and validations are documented.

After the field and laboratory data are reviewed, another level of review is performed once the data are combined into a data set. This review step as specified in Table D2 is performed by the NRA Data Manager and QAO. Data review, verification, and validation tasks to be performed on the data set include, but are not limited to, the confirmation of lab and field data review, evaluation of field QC results, additional evaluation of anomalies and outliers, analysis of sampling and analytical gaps, and confirmation that all parameters and sampling sites are included in the QAPP.

Another element of the data validation process is consideration of any findings identified during the monitoring systems audit conducted by the TSSWCB QAO. Any issues requiring corrective action must be addressed, and the potential impact of these issues on previously collected data will be assessed. After the data are reviewed and documented, the NRA Project Manager validates that the data meet the data quality objectives of the project and are suitable for reporting to TSSWCB.

If any requirements or specifications of the SWQM for Copano Bay TMDL project are not met, based on any part of the data review, the responsible party should document the nonconforming activities and submit the information to the NRA Data Manager with the data. This information is communicated to the TSSWCB by the NRA in the Data Summary.

Table D2.1: Data Review Tasks

Field Data Review	**Responsibility**
Field data reviewed for conformance with data collection, sample handling and chain of custody, analytical and QC requirements	NRA QAO
Post-calibrations checked to ensure compliance with error limits	NRA QAO
Field data calculated, reduced, and transcribed correctly	NRA QAO
Laboratory Data Review	
Laboratory data reviewed for conformance with data collection, sample handling and chain of custody, analytical and QC requirements to include documentation, holding times, sample receipt, sample preparation, sample analysis, project and program QC results, and reporting	LCRA ELS,TAMU-CC/EML, NRA QAO
Laboratory data calculated, reduced, and transcribed correctly	LCRA ELS, TAMU-CC/EML, NRA QAO
LOQs consistent with requirements for Ambient Water Reporting Limits.	LCRA ELS, TAMU-CC/EML, NRA QAO
Analytical data documentation evaluated for consistency, reasonableness and/or improper practices	LCRA ELS, TAMU-CC/EML, NRA QAO
Analytical QC information evaluated to determine impact on individual analyses	LCRA ELS, TAMU-CC/EML, NRA QAO
All laboratory samples analyzed for all parameters	LCRA ELS, TAMU-CC/EML, NRA QAO
Data Set Review	
The test report has all required information as described in Section A9 of the QAPP	NRA Data Mgr, NRA QAO
Confirmation that field and lab data have been reviewed	NRA Data Mgr, NRA QAO
Data set (to include field and laboratory data) evaluated for reasonableness and if corollary data agree	NRA Data Mgr, NRA QAO
Outliers confirmed and documented	NRA Data Mgr, NRA QAO
Field QC acceptable (e.g., field splits and trip, field and equipment blanks)	NRA Data Mgr, NRA QAO
Sampling and analytical data gaps checked and documented	NRA Data Mgr, NRA QAO
Verification and validation confirmed. Data meets conditions of end use and are reportable	NRA Project Manager

D3 RECONCILIATION WITH USER REQUIREMENTS

Data produced in this project, and data collected by other organizations (i.e.—USGS, TCEQ), will be analyzed and reconciled with project data quality requirements. Data meeting project requirements will be used for TMDL development, stream standards modifications, and permit decisions as appropriate. Data which do not meet requirements will not be considered appropriate for any of the uses noted above.

Appendix A SWQM for Copano Bay TMDL Work Plan

Tasks, Objectives and Schedules						
Task 1:	Project Administration and Coordination					
Costs:	Federal:	$1,207	Non-Federal:	$72,000	Total:	$73,207
Objective:	To effectively coordinate and monitor all work performed under this project including technical and financial supervision and preparation of status reports.					
Subtask 1.1:	NRA will prepare electronic quarterly progress reports (QPRs) for submission to TSSWCB. Progress reports shall document all activities performed within a quarter and shall be submitted by the 15th of January, April, July, and October. All progress reports will also be provided to TCEQ.					
	Start Date:	December 1, 2006		Completion Date:		November 30, 2010
Subtask 1.2:	NRA will perform accounting functions for project funds and will submit appropriate Reimbursement Forms to TSSWCB at least quarterly.					
	Start Date:	December 1, 2006		Completion Date:		November 30, 2010
Subtask 1.3:	NRA will participate in the Copano Bay TMDL stakeholder meetings in order to efficiently and effectively achieve project goals and to summarize activities and achievements made throughout the course of this project.					
	Start Date:	December 1, 2006		Completion Date:		November 30, 2010
Deliverables	• Quarterly Progress Reports in electronic format. • Reimbursement Forms in either electronic or hard copy format.					

Tasks, Objectives and Schedules						
Task 2:	Routine Ambient Surface Water Quality Monitoring					
Costs:	Federal:	$6,689	Non-Federal:	$49,725	Total:	$56,414
Objective:	To provide water quality data to support the on-going TMDL for bacteria in oyster ways in Copano Bay by enhancing current routine ambient monitoring regimes.					
Subtask 2.1:	Currently, routine ambient monitoring is conducted quarterly at 7 stations by NRA (12943, 12944, 12945, 12947, 12952, 13404, and 13405) and quarterly at 2 stations by TCEQ (14783 and 17724). NRA and TCEQ will add *E. coli*, enterococcus, and fecal coliform samples to their routine sampling (when not already included) in support of the project. TAMU-CC Environmental Microbiology Laboratory will conduct the bacteria analysis.					
	Start Date:	September 1, 2007		Completion Date:		November 30, 2010
Deliverables	• Water quality data from routine ambient monitoring as reported through Tasks 1 and 6.					

Tasks, Objectives and Schedules						
Task 3:	Targeted Watershed Surface Water Quality Monitoring					
Costs:	Federal:	$150,504	Non-Federal:	$77,253	Total:	$227,757
Objective:	To provide water quality data to support the on-going TMDL for bacteria in oyster ways in Copano Bay by enhancing current routine ambient monitoring regimes through bi-monthly targeted watershed monitoring.					
Subtask 3.1:	Prior to any wet weather sampling events, NRA will conduct field surveys to document stream bed profiles at sites without USGS flow gages. This will allow for flow estimates to be used during times when high flow prohibits actual measurements.					
	Start Date:	September 1, 2007	Completion Date:	November 30, 2010		
Subtask 3.2:	NRA is expecting to conduct bi-monthly targeted sampling at up to 26 sites to support the modeling effort. The specific sites have yet to be determined. These sites may vary for each year of the project and will most likely be located on unclassified tributaries of the Mission and Aransas Rivers. See table on page 5 and map on page 6 for potential sites. The QAPP, as detailed in Task 5, precisely identify sites. Sampling period extends through 39 months. Total number of sample events scheduled for collection through this subtask is up to 24 events. It is anticipated that some of the sites will be dry during some of the events. LCRA's Environmental Services Laboratory will conduct sample analysis for conventional parameters and the TAMU-CC Microbiology Laboratory will conduct bacteria analysis. Field parameters are pH, temperature, specific conductance (conductivity), dissolved oxygen, physical water qualities, current weather conditions, and flow severity. Conventional parameters are TSS and turbidity. Flow parameters (non-tidal segments) are flow collected by gage, electric, mechanical, Doppler, or flow estimates. Bacteria parameters are *E. coli*, enterococcus, and fecal coliform.					
	Start Date:	September 1, 2007	Completion Date:	November 30, 2010		
Deliverables	• Water quality data from bi-monthly targeted watershed monitoring as reported through Tasks 1 and 6.					

Tasks, Objectives and Schedules						
Task 4:	Effluent Surface Water Quality Monitoring					
Costs:	Federal:	$49,950	Non-Federal:	$0	Total:	$49,950
Objective:	To provide water quality data to support the on-going TMDL for bacteria in oyster waters in Copano Bay by enhancing current routine ambient monitoring regimes through monthly effluent monitoring.					
Subtask 4.1:	WWTF end-of-pipe samples will be collected by TCEQ personnel on the days of the targeted monitoring events, if possible. There are 16 permitted dischargers in the Copano Bay watershed. Coordination with TCEQ will be required. LCRA's Environmental Services Laboratory will conduct sample analysis for conventional parameters and the TAMU-CC Microbiology Laboratory will conduct bacteria analysis. Conventional parameters are TSS and turbidity. Bacteria parameters are *E. coli*, enterococcus, and fecal coliform.					
	Start Date:	September 1, 2007	Completion Date:	November 30, 2010		
Deliverables	• Water quality data from monthly effluent monitoring as reported through Tasks 1 and 6.					

Tasks, Objectives and Schedules						
Task 5:	Quality Assurance					
Costs:	Federal:	$0	Non-Federal:	$4,800	Total:	$4,800
Objective:	To develop and implement DQOs and QA/QC activities to ensure water quality data of known and acceptable quality are generated through this project.					
Subtask 5.1:	NRA will develop a QAPP for activities in Tasks 2-4 consistent with *EPA Requirements for Quality Assurance Project Plans (QA/R-5)* and the *TSSWCB Environmental Quality Management Plan*. Consistency with Title 30, Chapter 25 of the Texas Administrative Code, *Environmental Testing Laboratory Accreditation and Certification*, which describes Texas' approach to implementing the National Environmental Laboratory Accreditation Conference (NELAC) standards, shall be required. All monitoring procedures and methods prescribed in the QAPP shall be consistent with the guidelines detailed in the *TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue (RG-415)* (December 2003) and *Volume 2: Methods for Collecting and Analyzing Biological Community and Habitat Data (RG-416)* (August 2005).					
	Start Date:	December 1, 2006	Completion Date:	August 31, 2007		
Subtask 5.2:	NRA will implement approved QAPP and submit revisions and amendments to the QAPP as needed.					
	Start Date:	September 1, 2007	Completion Date:	November 30, 2010		
Deliverables	• QAPP for Tasks 2-4 approved by TSSWCB and USEPA in both electronic and hard copy formats. • Data of known and acceptable quality as reported through Tasks 1 and 6.					

Tasks, Objectives and Schedules						
Task 6:	Data Management and Final Report					
Costs:	Federal:	$6,038	Non-Federal:	$14,400	Total:	$20,438
Objective:	To manage and transfer monitoring data for use in the TMDL for bacteria in oyster waters in Copano Bay and for inclusion in the TCEQ SWQMIS and to develop a final report summarizing the results and activities of the project.					
Subtask 6.1:	NRA will submit Station Location Requests as needed to obtain TCEQ stations numbers for new monitoring sites from activities in Tasks 3-4.					
	Start Date:	December 1, 2006	Completion Date:	November 30, 2010		
Subtask 6.2:	NRA will submit monitoring data from activities in Tasks 2-4 to TSSWCB for inclusion in the TCEQ SWQMIS. Data will be transferred in the correct format using the TCEQ file structure, along with a completed Data Summary. Data Correction Request Forms will be submitted to TSSWCB whenever errors are discovered in data already reported.					
	Start Date:	September 1, 2007	Completion Date:	November 30, 2010		
Subtask 6.3	NRA will post monitoring data from activities in Tasks 2-4 to the NRA website in a timely manner.					
	Start Date:	September 1, 2007	Completion Date:	November 30, 2010		
Subtask 6.4	No independent final report will be prepared for this project. Rather, NRA will summarize the results and activities of this project through inclusion in NRA's Clean Rivers Program Basin Highlights Report and/or Basin Summary Report. Additionally, the results and activities of this project may be summarized in the TMDL for bacteria in oyster waters in Copano Bay.					
	Start Date:	December 1, 2006	Completion Date:	November 30, 2010		
Deliverables	• Station Location Request Forms (as needed) in electronic format. • Monitoring data files and Data Summary in electronic format. • Data Correction Request Forms (as needed) in electronic format. • Monitoring data updates posted to the NRA website. • Final report (NRA CRP BHR and/or BSR) at culmination of project in both electronic and hard copy formats.					

Appendix B Sampling Process Design and Monitoring Schedule (plan)

Sample Design Rationale

The sample design is based on the data needs for the watershed bacterial loading model being development for the Copano Bay TMDL for Bacteria. Sites were selected that would help define the loading sources and amounts from most of the upper subwatersheds, not just the cumulative effect in the lower portion of the watershed. All road crossings on all creeks, streams, and rivers were evaluated for applicability and accessibility. 14 of 48 sites were selected.

Site Selection Criteria

This data collection effort involves monitoring for bacteria, TSS, and turbidity using procedures that are consistent with the State's accepted monitoring program, for the purpose of data entry into the watershed bacterial loading model being developed by the University of Texas at Austin, CWRW. To this end, some general guidelines are followed when selecting sampling sites, as basically outlined below, and discussed thoroughly in the *TCEQ Surface Water Quality Monitoring Procedures, Volume 1* (RG-415). Overall consideration is given to accessibility and safety.

1. Locate stream sites so that samples can be safely collected from the centroid of flow. Centroid is defined as the midpoint of that portion of stream width which contains 50 percent of the total flow. Avoid backwater areas or eddies when selecting a stream site.

2. Routine bi-monthly monitoring sites may be selected to bracket sources of pollution, influence of tributaries, changes in land uses, and hydrological modifications.

3. Sites should be accessible. When possible, stream sites should have a USGS stream flow gauge. If not, it should be possible to conduct flow measurement during routine visits.

Monitoring Sites

Monitoring Tables for SWQM for Copano Bay TMDL monitoring are presented on the following pages in Table B1.1. Station location maps are included in Section A5. Table B1.2 in Appendix B lists the WWTFs that will also be sampled.

Table B1.1 Sample Design and Schedule, FY 2010 [1,2,3]

SWQM for Copano								
Description	**Station**	**Region**	**SC2**	**Conv**	**Bacteria**	**Flow**	**Field**	**Comments**
Segment 2002 - Mission River Above Tidal								
Mission River Above Tidal at US 77	12944	14	NR	9	9	9	9	
Medio Creek at US 59	20064	14	NR	9	9	9	9	
Medio Creek at Kelly Rd.	20063	14	NR	9	9	9	9	
Sarco Creek at FM 2441	20062	14	NR	9	9	9	9	
Blanco Creek at US 59	20061	14	NR	9	9	9	9	
Sarco Creek at FM 3410	20060	14	NR	9	9	9	9	
Medio Creek at FM 623	20059	14	NR	9	9	9	9	
Aransas River Tidal at US 77	12948	14	NR	9	9	9	9	
Aransas River Near Skidmore	12952	14	NR	9	9	9	9	
Poesta Creek at US 181 Bypass	12932	14	NR	9	9	9	9	
Aransas Creek at FM 888	20066	14	NR	9	9	9	9	
Papalote Creek at US 181	20065	14	NR	9	9	9	9	
Copano Creek at FM 774	13660	14	NR	9	9	9	9	
Chiltipin Creek at SH 89	20063	14	NR	9	9	9	9	

1 SC1 for all samples is TX.
2 Program code for all samples beginning November 2009 will be RT as the remaining sample will take place regardless of flow.
3 It is anticipated that sampling will take place monthly through July 2010.

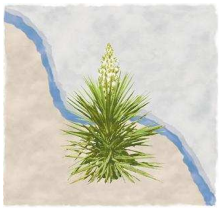
Table B1.2 WWTP Outfall Sample Locations

Map #	WWTP Permit #	Description
1	WQ0004290-000	Holiday Beach WSC*
2	WQ0003487-000	Town of Bayside**
3	WQ0013892-001	Town of Bayside
4	WQ0010705-001	City of Taft
5	WQ0013412-001	TxDOT***
6	WQ0010055-001	City of Sinton
7	WQ0013641-001	City of Sinton – Rob and Bessie Welder Park***
8	WQ0014119-001	St. Paul WSC
9	WQ0010237-001	City of Odem
10	WQ0014123-001	Tynan WSC
11	WQ0014112-001	Skidmore WSC
12	WQ0010255-001	Town of Refugio
13	WQ0010124-002	City of Beeville
14	WQ0010748-001	Pettus MUD
15	WQ0010156-001	Town of Woodsboro
16	WQ0010124-004	City of Beeville – Chase Field

*Decision not to sample – no-discharge permit
**Decision not to sample – no longer active
***Decision not to sample after first day of first event – evaporation ponds, no discharge

Critical vs. non-critical measurements
All data is for the Copano Bay TMDL project.

Appendix C Field Data Sheets



Nueces River Authority
Field Data Sheet

Date: _____ Hydrolab # : _____

Sampling Location: _____ Station ID: _____

Time Collected: _____ Time In: _____

Sample Depth: _____ Time Out: _____

Sample Collector Name/s and initial/s: _____

Storet Code	Value	Parameter
00020		Air Temp (°C)
00010		Water Temp (°C)
00400		pH (s.u.)
00300		DO (mg/L)
		DO (% Saturation)
00094		Conductivity (Φmhos/cm)
00480		Salinity (ppt) Tidal only
00078		Secchi Disk (meters)
89969		Water Color 1=Brown 4=Black 2=Reddish 5=Clear 3=Green 6=Other
89971		Water Odor 1=Sewage 5=Fishy 2=Oily/Chemical 6=None 3=Rotten Eggs 7=Other 4=Musky
89968		Water Surface 1=Calm 3=Waves 2=Ripples 4 = White Caps
88842		Turbidity 1=Low 2=Medium 3=High
89972		Tide Stage 1=Low 4=Rising 2=Falling 5=High 3=Slack

Storet Code	Value	Parameter
01351		Flow Severity (non tidal only) 1=No Flow 4=Flood 2=Low 5=High 3=Normal 6=Dry
00061		Flow (cfs) (non-tidal only)
89835		Flow Measurement method (non tidal only) 1=Gage 4=Weir/Flume 2=Electric 5= Doppler 3=Mechanical
74069		Flow Estimate (cfs)
72053		Days Since Last Precipitation
82553		Rainfall (Inches past 1 day)
82554		Rainfall (Inches past 7days)
89966		Present Weather 1=Clear 3 = Overcast 2 = Cloudy 4 = Rain
89965		Wind Intensity 1=Calm (0) 3=Moderate (8-18) 2=Slight(1-7) 4=Strong (19+)
89010		Wind Direction 1=North 5=Northeast 2=South 6=Southeast 3=East 7=Northwest 4=West 8=Southwest
		Average wind speed _____ mph

Measurement comments and field observations:

Date: _____ Hydrolab #: _____

Sampling Location: _____ Station ID: _____

_____ Time In: _____

Time Collected: _____ Time Out: _____

Sample Collectors: _____

Storet Code	Value	Parameter
00020		Air Temp (°C)
00078		Secchi Disk (meters)
89969		Water Color 1=Brown 4=Black 2=Reddish 5=Clear 3=Green 6=Other
89971		Water Odor 1=Sewage 5=Fishy 2=Oily/Chemical 6=None 3=Rotten Eggs 7=Other 4=Musky
89968		Water Surface 1=Calm 3=Waves 2=Ripples 4=White Caps
88842		Turbidity 1=Low 3=High 2=Medium

Storet Code	Value	Parameter
72053		Days since Last Precipitation
82553		Rainfall (Inches past 1 day)
82554		Rainfall (Inches past 7 day)
89966		Present Weather 1=Clear 3=Overcast 2=Cloudy 4=Rain
		Average Wind Speed _____mph
89965		Wind Intensity 1=Calm (0) 3=Moderate (8-18) 2=Slight(1-7) 4=Strong (19+)
89010		Wind Direction 1=North 5=Northeast 2=South 6=Southeast 3=East 7=Northwest 4=West 8=Southwest

Storet Code	Parameter	Value	Value	Value	Value	Value	Value
	Depth						
00010	Water Temp (°C)						
00400	pH						
00300	DO (mg/L)						
	DO (% Saturation)						
00094	Conductivity (Φmhos/cm)						

Storet Code	Parameter	Value	Value	Value	Value	Value	Value
	Depth						
00010	Water Temp (°C)						
00400	pH						
00300	DO (mg/L)						
	DO (% Saturation)						
00094	Conductivity (Φmhos/cm)						

Sampling Location: ____

Station Identification (ID): _______________________ Date: ___________

Time Begin: _______ Time End: _______ Meter Type: ___________________

Observers: ____________ Stream Width: _______ Section Width*: _________

Observations: ____

Section Midpoint (ft)	Section Depth (ft)	Observational Depth (ft)	Velocity (V)		Area (A) W x D (ft^2)	Discharge (Q) V x A (ft^3/s)
			At Point (ft/s)	Average (ft/s)		
**						

Total Discharge (Σ Q) (ft^3/s)	

*For streams widths less <5.0 feet, use section widths of 0.5 feet. If the stream width is >5.0 feet, use the following calculation to figure section width: (section width = stream width / (20-30).

** For stream widths >5.0 feet, the midpoint of the first section is calculated by dividing the section width in half.

Appendix D Chain of Custody Forms

CUSTOMER RECORD and ANALYSIS

Shipper Receipt Number _____

Send Results to: Sam Sugarek
Nueces River Authority
Address: 1201 N. Shoreline Blvd.
Corpus Christi, TX 78401

NUECES RIVER AUTHORITY

Lab Analysis Request

Phone:	Fax:	Project Name:	Project No.:
361-825-3193	**361-825-3195**	Clean Rivers Program Monitoring Copano Bay TMDL	CRP NRA/LCRA/ TAMU-CC

Sampling by:			**Matrix**		**Preserved (w/ice)**		**Sampling**		**Turbidity SM 2130-B**	**TSS EPA 160.2**		***Escherichia coli* EPA 1103.1**	**Enterococci EPA 1600**	**Fecal Coliform SM 92223-D**										
Site Identification:	**Lab Only**	**No. Containers**	**Liquid** –			**Ice/ Ref**	**Date**	**Time**																

Relinquished by:	**Date**	**Time**	**Received By:**	**Date**	**Time**	**Remarks:** X = laboratory measurement

Appendix E Data Summary

Data Summary

Data Information

Data Source: _____

Date Submitted: _____

Tag_id Range: _____

Date Range: _____

Comments

Please explain in the space below any data discrepancies including:

- **Inconsistencies with AWRL specifications;**
- **Failures in sampling methods and/or laboratory procedures that resulted in data that could not be reported to the TCEQ; and**
- **Other discrepancies.**

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

NRA Data Manager: _____

Date: _____

Appendix F Corrective Action Report

Corrective Action Report
CAR #:_____

Date:_____ Area/Location:_____

Reported by:_____ Activity:_____

State the nature of the problem, nonconformance or out-of-control situation:

_____
_____
_____
_____
_____

Possible causes:

_____
_____

Recommended Corrective Actions:

_____

_____

CAR routed to:_____

Received by:_____

Corrective Actions taken:

_____

_____

_____

Has problem been corrected?: YES NO

Immediate Supervisor:_____

Program Manager:_____

Quality Assurance Officer:_____

ATTACHMENT 1
Example Letter to Document Adherence to the QAPP

TO: (name)
(organization)

FROM: Rocky Freund
Nueces River Authority

Please sign and return this form by (date) to:

Nueces River Authority
Coastal Bend Division
1201 N. Shoreline Blvd.
Corpus Christi, Texas 78401

I acknowledge receipt of the referenced document(s). I understand the document(s) describe quality assurance, quality control, data management and reporting, and other technical activities that must be implemented to ensure the results of work performed will satisfy stated performance criteria.

_____

Signature Date